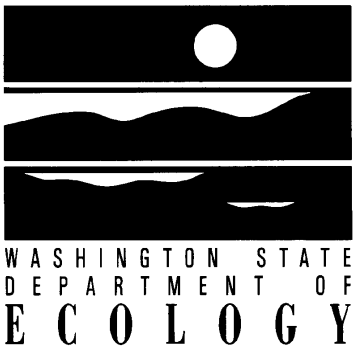

GUIDELINES
FOR
PREPARATION OF ENGINEERING REPORTS
FOR
INDUSTRIAL WASTEWATER
LAND APPLICATION SYSTEMS

May 1993
Publication #93-36

G U I D E L I N E S
FOR
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INDUSTRIAL WASTEWATER
LAND APPLICATION SYSTEMS

Water Quality Program
Water Quality Technical Guidance
Olympia, WA 98504-7600

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PREFACE

The review and approval process for engineering documents submitted to Ecology are outlined in Chapter 1, General Engineering Requirements in *Criteria For Sewage Works Design,* December 1998, and *Submission of Plans and Reports for Construction of Wastewater Facilities,* Chapter 173-240 WAC.

One of two types of engineering reports is required for land application of industrial wastewater: 1) Abridged Engineering Report (Chapter 3) or 2) Detailed Engineering Report (Chapter 4). Either engineering report must address the items listed in General Design Considerations (Chapter 2). The proponent is encouraged to contact the appropriate Department of Ecology Regional Office to determine if additional specific guidance has been developed to address local conditions.

These guidelines include four chapters. Chapter 1 is the introduction and includes a statement of the overall design objectives. Chapter 2 contains design elements that are common to both Abridged Engineering Reports (Chapter 3) and Detailed Engineering Reports (Chapter 4). Each element in Chapter 2 contains a purpose statement or explanation of the significance of the element. Chapter 3 (Abridged Engineering Report) establishes the eligibility and minimum elements for an Abridged Engineering Report. Chapter 4 describes the content required in Engineering Reports for all other industrial land application projects.

This is a guidance document, prepared by Ecology for the benefit of its staff and the designers, owners, and operators of land application systems. This document is not a regulation, but the information in this guidance document is intended to address those data requirements that will lead to an approvable engineering report.

Chapter 1 - Introduction

In principle, the land application of wastewater uses the physical, chemical and microbial properties of the soil and vegetation to remove contaminants from the applied wastewater. The upper soil-plant zone is used to stabilize, transform, or immobilize wastewater constituents and support crop growth, leading to an environmentally acceptable assimilation of the waste. When proper design principles are used, land application is a desirable method of wastewater treatment.

This document defines the minimum content and considerations required for the preparation of an engineering report for land application of industrial wastewater as provided in WAC 173-240-130(2) and as defined in WAC 173-216-030(7). An engineering report is required prior to construction of new facilities, facilities modifications, or in response to permit conditions or administrative orders. A properly designed and operated land application system should:

- Maintain the highest quality of the state's ground water and protect existing and future beneficial uses of the ground water.

- Not endanger public health or welfare.

Deviations from these guidelines may be accepted when there is appropriate technical and engineering justification.

Chapter 2 - General Design Considerations

This chapter presents some of the most important design elements of an industrial land application system. These elements have the potential to significantly affect the performance of a land application system. Variations in manufacturing production over a minimum five-year project life shall be considered in the design of land application systems.

Climatic data

Purpose: Climatic factors significantly influence the performance of many elements of land application systems.

Air temperature affects the ability to distribute water, the evaporation rate, and treatment processes. Soil temperature affects plant growth, nutrient uptake, and biological activity in the soil. Soil moisture affects water holding capacity.

A 10-year recurrence interval for the duration of the design event is recommended for water budget calculations using soil temperature, air temperature, solar insulation, pan evaporation, evaporation, wind speed, and precipitation.

Topography

Purpose: Topography affects runoff patterns, the ability to distribute the wastewater and, therefore, the amount of water that can be applied.

Runoff as a result of the land application of wastewater is not allowed. Water, snowmelt, or rain runoff or run-on at the land application should be minimized. The selection of the irrigation system should be compatible with the site topography. Close attention should be given to high rate application systems when slopes exceed 4 percent on soils with a high erosion index. When selecting the application equipment, the design must at least take into account the site topography, soil infiltration rates, soil water holding capacity, crop type, and expected operational and management practices necessary for a successful system.

Revegetation to minimize runoff or run-on is recommended where natural grades are modified.

Topographic maps must depict slopes for the entire area where wastewater will be applied and at a suitable contour interval at least as detailed as the 7.5 minute USGS (United States Geological Survey) quadrangle.

Soils

Purpose: Soils support crop growth and a biological community which removes BOD, and other pollutants that are not removed through treatment prior to application or through crop uptake.

Soil structure, texture, chemistry, and hydraulic characteristics must be compatible with the proposed application of wastewater. Soil resources should be mapped to standards acceptable to the NCSS (National Cooperative Soil Survey). NCSS Order 2 mapping is anticipated to be

acceptable in most cases. All of the elements of the soils field description should be made using standards set by the NCSS.

Crops

Purpose: The crop is a critical component in many land application systems and is relied upon for removing nutrients, reducing erosion, and maintaining or increasing infiltration rates.

Crop selection should be based on its ability to use the available nutrients under actual site conditions. Include a table showing the crops to be grown, acreage available, expected crop yield, and nutrients available in the wastewater. Crops also should be suitable for the soil, climate, and other site conditions. Periodic harvesting of the crop is necessary for effective nutrient removal.

Water that will not inhibit crop growth should be used to establish the cover crop. In general, wastewater should only be applied to a well-established cover crop.

Livestock grazing on the land application site is not recommended. If livestock are allowed to graze on the land application site, the irrigation plan, crop management plan, and monitoring plans should reflect the increase in.net nutrient loading and that soil compaction will reduce infiltration rates. Special care must be taken to protect sprinklers, risers, pipes, and monitoring wells from damage caused by animals allowed access to the site. Cross fencing with managed livestock rotation is recommended.

Wetlands

Purpose: Runoff and percolation from land application sites can adversely impact wetlands by altering hydroperiod, flow, and water quality. Wetland functions and uses can be protected through proper identification and appropriate control of runoff and percolation.

Wetlands rated as Category 1 or 2 are not appropriate for use in wastewater treatment. Wetlands rated as Category 3 or 4 may be used for wastewater treatment when it is demonstrated through a site evaluation that the proposed use would not: 1) degrade or eliminate characteristic uses, and 2) degrade existing functions and values.

If a Category 3 or 4 wetland is used for treatment, the land application of wastewater should not: 1) result in nutrient loading that will disrupt plant communities or wetland functions, 2) negatively alter hydroperiodicity, or 3) reduce flow storage characteristics.

All wetlands on the land application site should be designated and rated. To designate a wetland use the *Federal Manual for Identifying and Delineating of Jurisdictional Wetlands,* 1989, U.S. Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and USDA Soil Conservation Service.

To rate a wetland as a category 1, 2, 3 or 4, use the *Washington State Wetlands Rating System; Western Washington or Eastern Washington,* October 1991, Washington State Department of Ecology Publications #91-57 and #91-58, as appropriate.

Land Use

Purpose: Zoning of the site and neighboring uses can significantly influence the design, operation, and public acceptance of a land application system.

Land uses on and adjacent to the land application site, current zoning, and planning restrictions should be identified. Agricultural and silvicultural lands are preferred for land application. Lands not zoned for industrial purposes often require conditional use permits from the local government or county government planning authority. The review associated with the conditional use permit must include SEPA environmental review.

Land Ownership/Agreements

Purpose: Land application sites are often removed from the site of operation and may not be under the ownership of the facility operator. Continued successful operation may depend on landowner agreements and appropriate property easements.

The design life of a wastewater facility is generally from 5-25 years. Fee simple purchase of the irrigation site is recommended. Agreements including a description of the wastewater constituents, concentration, availability, and use are recommended. A lease/easement is acceptable if the duration of the lease is 5 years or greater. The lease/easement agreement should provide for a minimum of two years prior notification of lease termination and the need to vacate the site.

Treatment Prior to Application

Purpose: Crop and soil may not treat all constituents in the wastewater. Treatment prior to application may be needed to: 1) improve operational efficiencies, 2) preserve the treatment potential of the land application site, 3) protect wetland functions and uses, and 4) protect water quality.

Some factors to consider when evaluating treatment needs are: 1) operation problems with the distribution system, 2) nuisance conditions during periods when wastewater is stored, 3) soil clogging or anaerobic conditions, and 4) solids smothering of leaf surfaces. Some examples of pollutants that may require additional treatment prior to application are: nutrients; total dissolved solids; solids; suspended solids; substances injurious to crop health; metals, such as boron, cadmium, copper, and sodium; BOD, and COD. Treatment alternatives may include disinfection, chopping, screening, skimming, settling, aeration, or chemical treatment.

Impoundments

Purpose: Wastewater impoundments may be needed for the facility to operate during periods when land application may be precluded by climatic or other conditions.

A wastewater impoundment is needed when:

- precipitation produces an excessive hydraulic load,
- cultivation or harvesting practices prevent application,
- climatic conditions prevent application,
- wastewater flow or quality variability requires equalization,
- as a backup system under emergencies, and
- periods when wastewater cannot be applied to the land or stored in the soil profile as provided in the Irrigation Management Plan.

If surface impoundment(s) are utilized for wastewater storage, embankments up to 15 feet in height should provide at least two feet of freeboard, embankments over 15 feet in height should provide 3.5 feet of freeboard. A dam safety permit is needed if the storage capacity exceeds 10 acre-feet. Plans and specifications should be prepared in accordance with Chapter 173-175 WAC. Embankments should be designed to withstand a 100-yr flood event. Storage lagoons should include a properly engineered liner which will comply with the *Water Quality Standards for Ground Waters of the State of Washington,* Chapter 173-200 WAC. A synthetic liner is strongly recommended for most land application storage systems. Any other recommended liner system must be justified.

Monitoring

Purpose: To: 1) record facility operation and management practices, 2) monitor effluent variations, 3) monitor treatment effectiveness, 4) evaluate soil and crop treatment effectiveness, and 5) determine compliance with water quality standards. The locations identified in the following tables are generally adequate to monitor the quality and quantity of wastewater applied to a site, the physical and chemical effects on the soil, and physical and chemical effects in ground water at the site.

The design engineer is responsible for determining pollutant assimilative capacity and selecting the design limiting constituents. These constituents should be identified and included in the monitoring program. Monitoring may be needed at various locations, such as: 1) effluent before irrigation, 2) soil, 3) vadose zone, 4) crop, and 5) ground water. A core monitoring program is required at the locations listed below. A recommended list of parameters of concern is also described below. Specific parameters may be deleted from the core monitoring program when ample justification is provided. Additional parameters may be required due to unique characteristics of the wastewater and/or of the land application site.

Location: Wastewater

Parameter	Method
Flow (gallons per day)	
Temperature	
Conductivity	Standard Methods #205[2]
pH	Standard Methods #423[2]
BOD_5[1]*	Standard Methods #507[2]
TDS (Total dissolved solids)[1]	Standard Methods #209A[2]
Nitrogen, Ammonia[1]	EPA Method 350.1[3]
Nitrate/nitrite (as N)[1]	EPA Method 353.2[3]
Total Kjeldahl nitrogen[1]	EPA Method 351.3[3]
Chloride[1]	Standards Methods #427[2]

*COD may be used to replace or in addition to BOD as a test parameter. It is not recommended by Ecology since this test method generates a dangerous waste.

Location: Land Application Site, Soil[4]

Parameter
Exchangeable Sodium Percentage of Cation Exchange Capacity
Cation Exchange Capacity[5]
Sodium
Potassium
Calcium
Magnesium
Other Cations

Location: Land Application Site, Ground Water[4]

Parameter
Water level
Temperature
Conductivity
pH
Nitrate (as N)[1]

1. Analysis shall be performed by an accredited laboratory per Accreditation of Environmental Laboratories, Chapter 173-50 WAC.
2. *Standard Methods for the Examination of Water and Wastewater,* 16th edition or latest edition.
3. *Table IB-List of Approved Inorganic Test Procedures,* 40 Code of Federal Regulations (CFR), Part 136 Revised as of July 1, 1991, or latest revision.

4. Analyses that must be performed immediately according to standard scientific practice (e.g., pH and temperature) may be performed at the land application site by facility staff.
5. Cation Exchange Capacity is measured by methods outlined in *Soil Survey Investigations Report No. 1, Procedures for Collection of Soil Samples and Methods of Analysis for Soil Survey,* Soil Conservation Service, USDA, revised July. 1984.

Monitoring frequencies will be established on a case-by-case basis using physical site conditions, industrial process, and industrial production specifics. Monitoring frequencies may be decreased if sampling data indicate no significant adverse trends.

Systems Operations

Purpose: The daily operation of a land treatment system can significantly affect treatment effectiveness and assure public acceptance by reducing or eliminating potential nuisance conditions.

Common problems associated with wastewater land application systems include drift of wastewater onto public roadways or onto adjacent residential properties, and odors from storage lagoons and sprayflelds where the wastewater is anaerobic. High winds can interfere with uniform application of the wastewater.

Many other site-specific issues may need to be addressed in order to operate an effective land application system. In this section, discuss operational considerations and identify appropriate operation measures needed to address them. Each of these operations issues should be considered when recommending setbacks. Generally accepted setbacks are as follows:

- A minimum fifty-foot buffer is required and must be maintained between the land application site and the boundaries of a category 1 or 2 wetland.

- A fifty-foot buffer zone to all surface water drainage systems.

Emergency Plans

Purpose: A planned response to emergencies can prevent or minimize damage to equipment, the land application site, and to the environment.

Emergency bypasses of wastewater can damage storage and treatment facilities and degrade water quality. Backup treatment systems, additional storage, or provisions to shut the facility down are design alternatives for responses to emergencies. An emergency response plan should include notification procedures and identify planned alternative methods of operation.

Chapter 3 - Abridged Engineering Report

An Abridged Engineering Report may be used to evaluate the suitability of wastewater and the proposed site for land treatment. The purpose of this report is to identify appropriate wastewater treatment for smaller dischargers which have a reduced potential to adversely affect the environment.

Preliminary Evaluation

The Abridged Engineering Report may be submitted for Ecology's approval if the wastewater:

a) Does not contain toxics; and
b) Meets at least three of the four following characteristics on a monthly average basis:

- Flow is 15,000 gallons per day or less and applied according to the crop agronomic needs;
- Total nitrogen is 35 mg/l or less;
- Total BOD_5 is 200 mg/l or less; and
- TSS is 200 mg/1 or less.

If the proposed project does not meet the above-described criteria for the Abridged Engineering Report, a Detailed Engineering Report will be required in accordance with the provisions of Chapter 4.

Abridged Engineering Report

An Abridged Engineering Report submitted for approval should contain the following minimum elements:

- Project Summary, including contact name, address, and telephone number, type of business, location of facility;
- Description of the production process, including a schematic of the plant wastewater sources;
- Description of the average quality and volume of wastewater generated per unit time;
- Description of seasonal variations in the wastewater (quantity and quality);
- Description of wastewater transport and storage systems;
- Effluent characterization;
- Hydraulic, nutrient, and organic loadings;
- Description and characterization of the soils;
- Site map showing: vegetation, soils, topography, depth to ground water, and sprayfield location(s), and size;
- Identification of public water supply wells within 1/4 mile of the land application site;
- Identification of all wells on the land application site(s) including a copy of the well logs, if available;
- Topographic maps of the land application site(s) should identify minimum, maximum, and average slopes where wastewater will be applied;

- Description of surface and subsurface drainage systems;
- Irrigation management plan;
- Monitoring plan;
- Description of adjacent land uses and existing land use plans; and
- Description of surface geology and regional hydrogeology at the proposed site using available information.

Approval Process

Ecology will review the Abridged Engineering Report for sufficiency. If Ecology determines that the proposed discharge satisfies the requirements in Chapters 2 and 3, engineering plans and specifications may be developed from the Abridged Engineering Report without further study. If Ecology cannot make that determination, a Detailed Engineering Report is required in conformance with the provisions of Chapters 4.

Chapter 4 Detailed Engineering Report

The purpose of the Detailed Engineering Report is to identify appropriate wastewater treatment for larger dischargers having a significant potential to adversely impact the environment. In addition to the requirements of Chapter 2, the Detailed Engineering Report must address all of the provisions in this section.

Project Summary

The project summary should summarize the facility design criteria and generally describe the land treatment system, including:

- Type of facility;
- Location of facility;
- Describe the production process;
- Schematic of the plant wastewater sources;
- Average quality and volume of wastewater generated per unit time;
- Seasonal variations in the wastewater quantity and quality;
- Wastewater transport and storage;
- Land application system design;
- Potential environmental impacts;
- Provisions for stormwater management and disposal; and
- Assessment of impacts to ground water.

Site Considerations

Information describing the location of the land application site should be provided using a map for reference. Items which should be identified on the map and described are:

- Method and route of delivery of wastewater to the land application site;
- Wastewater storage and/or facilities for treatment prior to application;
- Land application site boundaries;
- Potential for expansion of land application site;
- Provisions for buffer zone surrounding land application site;
- Vegetation;
- Rock outcrops;
- Wells on the land application site;
- Current and historical land uses;
- Floodways and floodplains, if applicable;
- Surface waters including wetlands (natural and constructed);
- Surface and subsurface drainage systems affecting the site; and
- Meteorological information such as prevailing wind direction, evaporation, and precipitation.

Site Geology

The surface geology and the geologic material underlying the proposed site should he described. A drilling location plan map and drilling logs should be submitted for borings referenced in the report. Specific areas which should be addressed include:

- Geologic column identifying the formation(s) underlying the site;
- Thickness and lithology of the surficial and bedrock formations;
- Identification of regional fault and fracture trends; and
- Identification of regional structural trends.

Wastewater Analysis

Analyses of wastewater with provision made for seasonal variations in quality or quantity are recommended. For new facilities, wastewater characterization may be based on similar facilities using similar processes. Operating facilities should characterize the wastewater using Section E of *State Waste Discharge Permit Application For Industrial Discharges to Land,* (form ECY 040-179, revised 4/92). Grab samples from specific production process lines may be recommended.

Solids Handling

The handling, treatment, reuse/recycling and disposal of wastewater solids should be discussed in a specific section of the report. Include a description of solids generation and handling procedures necessary to prevent entry of the solids or its leachate, into surface or ground waters. The discussion should address the sources and generation rates of process solids and wastewater solids that may be utilized for beneficial purposes.

Soils Characterization

A soils report evaluating the physical and chemical characteristics of the soils on the site should include:

- A NCSS (National Cooperative Soil Survey) Order 2 mapping of the land application sites;
- Field descriptions of texture, color mottling, structure, depth, thickness, type of each horizon and presence or absence of restrictive horizons, depth of evidence of high water table;
- Soil runoff potential and infiltration rate in the soil mapping and characterization;
- Cation exchange capacity;
- Exchangeable Sodium Percentage;
- Electrical conductivity;
- Percent slope, rock fragments and size, and organic matter in each horizon;
- Field descriptions for clastic dikes and soil gleization (anaerobic conditions);
- Soil porosity, pH, and available water holding capacity;

- Recommended wastewater irrigation rates based upon the ability of the soil to treat the wastewater; and
- Recommended soil monitoring program.

It is strongly recommended that the soils report be prepared by a soil scientist or other specialist meeting the definition of a soil scientist.

Hydrogeologic Characterization

A hydrogeologic report describing the aquifers underlying the site should contain as much of the following information as is pertinent and available:

- A map showing depth and static water level (and date obtained) for wells within one mile of the site;
- A map showing regional hydraulic gradient for each aquifer;
- Lithologic description of aquifers and aquitards;
- Depths of aquifers;
- Saturated thickness of each aquifer;
- Specific capacity of wells included in study area;
- Aquifer characteristics, including transmissivity, hydraulic conductivity, seasonal water level variations, and seepage velocity; and
- Identify each well on the site and include a copy, of the well log.

The Department of Ecology, using generally accepted scientific and engineering principles, may determine that a hydrogeologic model of potential impacts to the ground water system is needed for particular wastewater parameters.

Design Considerations

Provide an analysis of the hydraulic, nutrient, and organic loading to the land application site. This analysis should include the following minimum elements:

- Nutrient loadings, including a monthly table showing: crop uptake (lbs/acre), total nitrogen and other nutrients applied (lbs/acre), and total nitrogen or nutrients stored in the soil and retained in the crop (lbs/acre);
- Hydraulic loading, with table showing monthly water use and balance showing: precipitation (inches), evapotranspiration (inches), wastewater applied (inches), supplemental water (inches), and total water applied (inches);
- Organic loading, with monthly table showing: total BOD_5 or COD applied (lbs/acre);
- A discussion of the BOD, or COD to nutrient ratio;
- Identification of other design limiting constituents, such as salts, substances poisonous to crops, and total dissolved solids; and
- Identification of design limiting parameter(s).

The proposed wastewater application loading rates should be based on the design limiting parameter(s).

Irrigation and Crop Management Plan

The irrigation management section should include a consideration of wastewater application at agronomic rates and should describe and evaluate:

- System efficiency and application uniformity;
- Soil water holding capacity;
- Irrigation water soil compaction potential;
- Infiltration rates;
- Salt leaching rates;
- Consumptive uses of the crop;
- Frequency of irrigation; and
- Timing of application.

A description of the crops or vegetation to be grown is required for all systems where vegetation is an integral part of the treatment system. A soil scientist should develop the crop management plan. The crop management plan should define design parameters such as:

- Method(s) of establishing a crop;
- Cropping patterns;
- Nutrient uptake;
- Salt tolerance threshold;
- Cultivation and harvesting requirements;
- Fertilizer, herbicide, and pesticide applications;
- Crop management;
- Expected crop yield;
- Supplemental irrigation water requirements for the crop;
- Expected irrigation return intervals for supplemental and wastewater applications for crop water consumption, and
- Recommended rest cycles for wastewater application where organic or hydraulic loading is a concern.

The system must be operated according to approved design loading and in a manner that will protect the existing and future beneficial use of the ground water.

Warm weather management should be done such that wastewater constituents of concern are chemically treated or biologically treated or removed by the crops to a degree that will minimize leaching loses. Application of wastewater during colder periods when biological and vegetation activities are low may not be appropriate if there are constituents of concern in the wastewater or treatment byproducts in the soil that would not be substantially stored in the root zone by physical or chemical means.

Wastewater must not be applied in a manner that would result in a surface discharge off the approved treatment site. Sites that would allow a surface discharge of wastewater or melt water due to slope and topography may not be appropriate for application when the soils are frozen or saturated.

The following conditions are to be avoided by proper design and management:

- The application of wastewater over all or portions of the site in quantities that significantly reduce or destroy the long-term infiltration rate of the soil.

- The application of wastewater over all or portions of the site in quantities that would cause long-term anaerobic conditions in the soil, especially when the microogranisms are highly active. Application under these conditions could result in excessive leaching of partial decomposition products or constituents of concern beyond the biological and root zones of the treatment system.

- The application of wastewater over all or portions of the site in quantities that would cause prolonged ponding of wastewater for periods long enough to produce objectionable odors or provide sustenance for insects or vectors from the ponded water.

- The application of wastewater over all or portions of the site in quantities or for durations that would cause unacceptable leaching losses of constituents of concern beyond the treatment zone or in excess of the approved design.

- The application of wastewater to bare soil at rates that destroy the short-term infiltration capability of the soil and for durations sufficient to cause objectionable odors from ponding or to cause site runoff.

Constituents of concern are constituents in the wastewater, partial decomposition products, or soil constituents that would alter ground water quality in amounts that would affect current and future beneficial uses.

DEFINITIONS

Unless otherwise specified, for the purpose of this guideline, the following definitions will be observed:

Active storage means the volume that would be released if the structure were to fail.

BOD_5 means 5-day biochemical oxygen demand.

Department or Ecology means the Washington State Department of Ecology.

EPA means the United States Environmental Protection Agency.

Flow Storage Characteristics means the capacity of a wetland to slow peak flow velocities from precipitation and runoff.

Hydroperiod means the seasonal occurrence of flooding and/or soil saturation; it encompasses depth, frequency, duration, and seasonal patterns of inundation.

Land application means the use of irrigation methods for the distribution of material(s) upon the land surface for the purpose of pollutant removal, assimilation, and/or utilization. Land application systems utilize soil, microorganisms, and vegetation as an integral treatment component to remove potential pollutants from the applied wastewater. Sludge utilization, and utilization of dewatered sludge are not considered land application.

Soil Scientist means an individual who is a registered as Certified or Registered Professional Soil Scientist or as Certified Professional Soil Specialist by American Registry of Certified Professionals in Agronomy, Crops, and Soils or by National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, master's or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

Suspended solids means total suspended solids (TSS).

Total nitrogen means the sum of nitrite nitrogen plus nitrate nitrogen, plus Kjeldahl nitrogen.

Toxics means pollutants regulated in 40 CFR Part 401.15 as revised as of July 1, 1991. As revised, there are 65 pollutant listed.

WAC means the Washington Administrative Code.

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, such as swamps, marshes, bogs, and similar areas. These do not include constructed wetlands that are designed for wastewater treatment.

Other generally used technical terms not defined above shall be defined in accordance with Glossary - Water and Wastewater Control Engineering, published by American Public Health Association (APHA), American Society of Civil Engineers (ASCE), American Water Works Association (AWWA), and Water Pollution Control Federation (WPCF) now referred to as the Water Environment Federation (WEF).

Units, of expression used are in accordance with those recommended in Manual of Practice Number 6, Units of Expression for Wastes and Waste Treatment, published by the Water Pollution Control Federation now referred to as the Water Environment Federation (WEF).

REFERENCES

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